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Effect of load intensity on heating in a polymer-bonded explosive

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The ignition behavior of a HMX/Estane polymer-bonded explosive under impact loading with flyer velocities of 200 – 1600 m/s is analyzed using a cohesive finite element method (CFEM) which accounts for large deformation, microcracking, and frictional heating. The formulation admits loading in both the shock and non-shock regimes. The study focuses on the changes in heating mechanisms as the load intensity increases. The heating in the microstructures is quantified in terms of the overall energy dissipation as well as hotspot clustering and density. It is found that microstructural attributes such as volume fraction of HMX, grain surface area, and clustering of grains significantly influence heating and the hotspot development, therefore, the ignition behavior of the materials. In addition, a shift in the dominant heating mechanism is seen as load intensity is increased from that of a non-shock nature to shock. Microstructure-performance relations are obtained.

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